



Mathematics Methods Units 3,4
Test 1 2018

Section 1 Calculator Free
Differentiation, Applications of Differentiation, Anti Differentiation

STUDENT'S NAME _____

DATE: Thursday 1st March

TIME: 30 minutes

MARKS: 28

INSTRUCTIONS:

Standard Items: Pens, pencils, drawing templates, eraser.

Questions or parts of questions worth more than 2 marks require working to be shown to receive full marks.

1. (5 marks)

Determine $\frac{dy}{dx}$ for the following. Do not simplify your answers.

(a) $y = \frac{x}{3x^3 - 2x + 5}$ [2]

(b) $y = \sqrt[3]{(2x^3 + 7)^5} (2 - x)$ [3]

2. (3 marks)

Given $y = \frac{u^3}{3} + 3u$ and $x = \frac{u+1}{2}$, determine $\frac{dy}{dx}$.

3. (5 marks)

Determine the value(s) of a under which the curve $y = x^3 + ax^2 + 3x + 2$ will have exactly one stationary point.

4. (9 marks)

Determine each of the following.

(a) $\int 3x^2 - \frac{1}{\sqrt{x}} + e \, dx$ [3]

(b) $\int \frac{2x^3 - 4x^2}{5x^2} \, dx$ [3]

(c) $\int \frac{-3}{\sqrt{7x+9}} \, dx$ [3]

5. (6 marks)

Using calculus techniques;

(a) Determine all stationary points of the function $y = \frac{x^3}{3} + 2x^2 + 3x - 2$ [3]

(b) Showing full algebraic reasoning state the nature of each of these stationary points. [3]



Mathematics Methods Units 3,4 Test 1 2018

Section 2 Calculator Assumed
Differentiation, Applications of Differentiation, Anti Differentiation

STUDENT'S NAME _____

DATE: Thursday 1st March

TIME: 20 mins

MARKS: 24

INSTRUCTIONS:

Standard Items: Pens, pencils, drawing templates, eraser.

Special Items: Three calculators, notes on one side of a single A4 page (these notes to be handed in with this assessment)

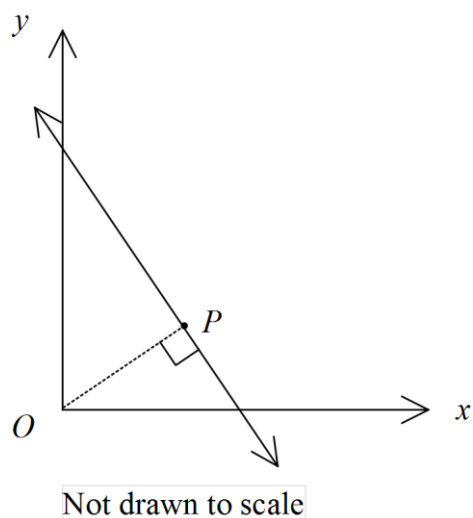
Questions or parts of questions worth more than 2 marks require working to be shown to receive full marks.

6. (3 marks)

A small metal sphere with a radius of 0.58 cm is dipped in gold. The coating of the gold is 0.02 cm thick. Use the derivative to approximate the increase in volume of the sphere.

7. (6 marks)

An ant crawls along the line $y = -10x + 38$ drawn on the axes below.



- (a) Given the minimum distance occurs at P, show that the length of OP is $\sqrt{x^2 + (-10x + 38)^2}$.

[2]

- (b) Using calculus techniques, determine the minimum distance between the ant and the origin and the location this occurs.

[4]

8. (7 marks)

The cost of a listed share in C cents, is modelled by $C = 75\sqrt{1+0.8t}$ for $t \geq 0$, where t is the number of years after 2000.

(a) Determine the cost per share in 2000. [1]

(b) Determine the average rate of cost rise between 2000 and 2010. [2]

(c) Determine the instantaneous rate of cost rise in 2005. [2]

(d) Determine when the instantaneous rate of cost rise is 10 cents per year. [2]

9. (8 marks)

A particle M moves in rectilinear motion such that its acceleration, a , in m/s^2 at any time, t , seconds(s) is given by:

$$a = 6t - 3 \text{ where } t \geq 0.$$

After 2 seconds, the particle's displacement is $-23m$ and it is travelling at a velocity of $-30ms^{-1}$

(a) By first determining the expression of velocity in terms of t , calculate the velocity of the particle after 1 second from its origin. [4]

(b) Determine the distance travelled by particle M from $t=2$ to $t=5$. [4]